

## Performance Assessment of a Variable-Flux Permanent-Magnet Memory Motor

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**Abstract :** The variable flux permanent magnet synchronous motor (VF-PMSM), also called "Memory Motor", is a new generation of motor capable of modifying the magnetization state with short pulses of current during operation or standstill. The impact of such operation is the expansion of the operating range in the torque-speed characteristic and an improvement in energy efficiency at high-speed in comparison to conventional permanent magnet synchronous machines (PMSMs). This paper reviews the operating principle and the unique features of the proposed memory motor. The benefits of this concept are highlighted by comparing the performance of the rotor of the VF-PMSM to that of two PM rotors that are typically found in the industry. The investigation emphasizes the properties of the variable magnetization and presents the comparison of the torque-speed characteristic with the capability of loss reduction in a VF-PMSM by means of experimental results, especially when tests are conducted under identical conditions for each rotor (same stator, same inverter and same experimental setup). The experimental results demonstrated that the VF-PMSM gives an additional degree of freedom to optimize the efficiency over a wide speed range. Thus, with a design easy to manufacture and with the possibility of controlling the magnetization and the demagnetization of the magnets during operations, the VF-PMSM can be interesting for various applications.

**Keywords :** efficiency, magnetization state, memory motors, performances, permanent-magnet, synchronous machine, variable-flux, variable magnetization, wide speed application

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